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PATTERN--A System for Land Management Planning

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ABSTRACT

Describes PATTERN (Planning Assistance Through Technical Evaluation of Relevance Numbers), a procedure for identifying and ranking key factors in land management decisions. Applies the technique to a hypothetical example.

KEYWORDS: planning, land management, priorities

INTRODUCTION

Land use and land management planning have become an ever-increasing concern since the beginning of the environmental movement of the early 1960's. The National Environmental Policy Act of 1969 (NEPA) added emphasis to this topic with its restrictions and directives. Since the adoption of this landmark legislation, additional regulations such as the Environmental Quality Improvement Act of 1970, Clean Air Act Amendment of 1970, and the Federal Water Pollution Control Act Amendment of 1972 have added even more directions and controls. Moreover, two additional laws, the Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA) and the National Forest Management Act of 1976 (NFMA), provide additional direction for land use and land management planning activities. Both pieces of legislation specify interdisciplinary planning and public input. All of these directives have contributed to the already complex process of planning and allocating.

In the early 1960's, Honeywell's[2] Military and Space Sciences Department developed a normative forecasting technique called PATTERN (**P**lanning **A**ssistance **T**hrough **T**echnical **E**valuation of **R**elevance **N**umbers) based on a mission-oriented *relevance tree* (Esch 1969). The relevance tree technique has been an aid in industry for identifying critical areas that required attention. Several other authors have also discussed and applied this forecasting technique in industrial situations (Gordon and others 1973; Jantsch 1968; Martino 1972). More recently this procedure has been applied in the outdoor recreation field (Shafer and others 1974; Shafer and Morrison[3]). This latter study was aimed at determining social and physical variables important in determining recreation management decisions. The technique was also used in integrating fire management and land management planning (Barney 1976).

As Shafer and Morrison[3] pointed out, PATTERN was originally developed and used most extensively for planning in the military sector; however, the methodology can be applied to other subject areas where decisions must be made and priorities must be determined. Furthermore, it seemed reasonable that PATTERN could be used to identify the most relevant factors in areas like resource allocation, fire management, and land management planning. The procedure helps isolate and set priorities for key elements in the planning and decision process.

This paper tells how to use PATTERN as a planning tool. PATTERN can be used by both the planner and the public. The specifics of the process are discussed and examples are shown. Additional readings are suggested for those who care to pursue the technique.

THE PATTERN PROCESS

How PATTERN functions is illustrated through an example adopted from Bright (1974). The original example provided more detail; however, this adaptation provides the basic elements.

To utilize PATTERN, we must first set an objective. Let us assume our objective is to purchase the best car for transportation needs. We begin by describing the situation and factors that might influence the eventual choice.

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[2]The use of trade, firm, corporation names in this publication is for the information and convenience of the reader. Such use does not constitute an official endorsement or approval by the U.S. Department of Agriculture of any product or service to the exclusion of others which may be suitable.

[3]Shafer, Elwood L., Jr., and Douglas A. Morrison. 1969. Some relevant factors for selecting recreation-development decisions. Unpubl. study plan on file at USDA For. Serv. Northeast. Exp. Stn., Broomall, Pa. 17 p.

Our situation might go like this: James and Mary Walsh have two children, 10 and 13 years old. James is a GS-12 engineer for the USDA Forest Service. His office is 20 miles from home. The home is located 10 miles from the school and 8 miles from the major shopping center. The family is outdoor oriented--skiing, camping, fishing, and hunting. They have a dog that often travels with them. The car they are driving now is 11 years old and needs a major overhaul. James spends 1 hour each day traveling to and from work. He needs a car that is easy to handle for all weather and road conditions. He is interested in a car with low maintenance, because his free time is limited and he is dependent on the car for transportation. Because of this dependency, he has decided to replace the car every 3 years; so he wants a car that will also have a good trade-in value.

This briefly covers the Walsh's situation. You should be able to picture the needs and desires for transportation. To use PATTERN you must first construct what is called a relevance tree. To keep the example simple, we will forego several options that could be developed in this tree. A simple relevance tree might look like figure 1. We have purposely limited the number of automobile makes and models. In actual practice, these choices can be limited because of availability, agreement of concerned parties, or by the fact that these might be the reasonable choices. Once the tree has been developed, we can present it in matrix form or table (fig. 2).

The axes of the matrix have special names: first-order and second-order relevance components. First-order relevance components are the most important items to consider and are listed down the left-hand column of the matrix. The user ranks each first-order component on a percentage basis according to its importance to the objective *within* the confines of the situation described. Second-order relevance components are those listed along the horizontal axis of the matrix. In either case rankings are based on the importance to the person making the ranking as related to the overall objective. The scores are developed by ranking on a percentage basis the second-order (horizontal items) relevance components as they relate to the first-order component of that row in the matrix.

The objective of this specific example is to select the best car for the situation. The features listed in figure 2 were taken from the situation and the relevance tree; the car models are those from which Mr. Walsh is prepared to make a choice. Figure 3 shows how Mr. Walsh filled in his relevance tree matrix. (Percentage values are entered in the matrix as decimals for ease of calculation.) He ranked mileage and handling as the two most important features, followed by maintenance; least important were comfort and resale.

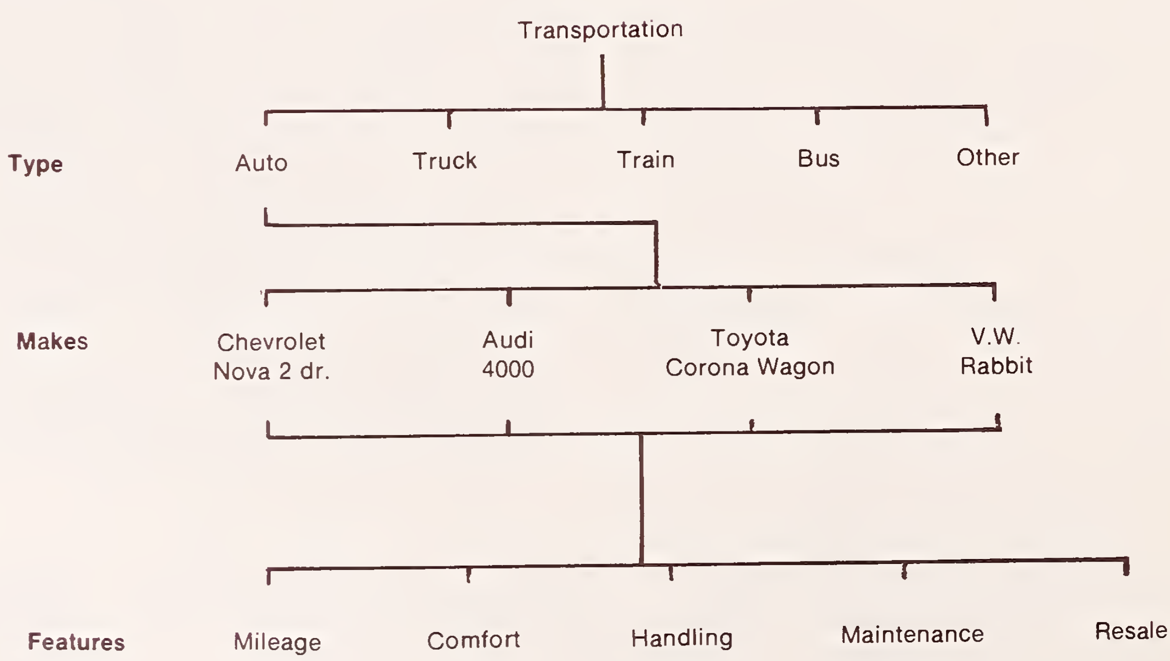

Figure 1.--A simple relevance tree.

Feature	Chev. Nova	Audi 4000	Toyota Corona Wagon	V.W. Rabbit
Mileage				
Comfort				
Handling				
Maintenance				
Resale				

Figure 2.--Relevance tree in matrix form.

Feature		Chev. Nova	Audi 4000	Toyota Corona Wagon	V.W. Rabbit	Total
Mileage	(0.30)	0.10	0.30	0.20	0.40	1.00
Comfort	(.10)	.20	.30	.25	.25	1.00
Handling	(.30)	.20	.30	.20	.30	1.00
Maintenance	(.20)	.40	.20	.20	.20	1.00
Resale	(.10)	.25	.25	.25	.25	1.00
Total	(1.00)					

Figure 3.--Mr. Walsh's completed relevance matrix, unadjusted scores, entered as decimals.

Now to fill in the second-level score. Walsh ranked each car model with respect to a particular feature. Looking at figure 3 again, we see that the car models, with respect to mileage, ranked: V.W. Rabbit, Audi 4000, Toyota Corona wagon, and Chevrolet Nova. Walsh ranked each car equally with respect to maintenance, except the Nova, which he apparently felt had twice as good a record for repairs. The resale potential was ranked equally for all models. Remember, this was Walsh's ranking; yours might be quite different. Each of these second-level relevance score row totals must total 100 percent.

Now that the input has been developed and the relative importance of each first-order and second-order component determined, we adjust the relevance scores. We first compute an adjusted relevance matrix. This is done by multiplying the first-level scores times the second-level scores of the same row in figure 3. For example, using the first row mileage, you would multiply 0.30 x 0.10 = 0.03, 0.30 x 0.30 = 0.09, 0.03 x 0.20 = 0.06, etc. Figure 4 illustrates the results of this adjustment procedure. Adding the appropriate row products and column products also provides a check on your arithmetic. The sum of the row totals (0.30 + 0.10 + 0.30 + 0.20 + 0.10) must be 1.00 or 100 percent, and the sum of the column totals (0.215 + 0.275 + 0.21 + 0.30) must also be 1.00 or 100 percent. From this adjusted relevance score matrix, we are able to develop averages, bar graphs, rank orders, and other related statistics to assist the decision process.

If each member of the Walsh family had prepared a relevance tree, we could develop an average tree by combining each matrix and determining an average percentage for each cell or square. The combined matrix would then represent the family's attitude regarding the car purchase.

As shown in figure 4, the total relevance score in the right-hand column should equal the first-level scores determined in figure 3, and the column should total 100 percent or 1.00. The totals for each column will also add up to 100 percent or 1.00. Based on the adjusted relevance data used here, the V.W. Rabbit ranked first; the Audi 4000, second; the Chevrolet Nova, third; and the Toyota Corona Wagon, last. This order might have changed if all the family data had been used or if you had done the ranking. Nevertheless, it does quantify how James Walsh feels about the situation. Within the relevance matrix, we can identify those combined items that have the higher adjusted relevance scores. For example, Rabbit/mileage was highest with 0.12. Audi/mileage, Audi/ handling, and Rabbit/handling were second with 0.09. The value, itself, is not as important as its relationship to the other values in the matrix. The combined scores illustrate some of the important internal components that make up the total values. Remember, these data do not provide the decision--people do. The data do, however, provide quantitative input into the decision process, which can be very helpful. The data also help identify those components and combinations of components that are important, and rankings of components.

Feature	Nova	Audi	Corona	Rabbit	Total
Mileage	0.03	0.09	0.06	0.12	0.30
Comfort	.02	.03	.025	.025	.10
Handling	.06	.09	.06	.09	.30
Maintenance	.08	.04	.04	.04	.20
Resale	.025	.025	.025	.025	.10
Total	**.215**	**.275**	**.21**	**.30**	**1.00**

Figure 4.--Adjusted relevance scores.

LAND MANAGEMENT APPLICATION

The Walsh's car purchase demonstrated how PATTERN works. To apply the system to land planning, we could utilize the same general sequence of events outlined in the car example. First of all, we need an objective for the specific land area in question. We would also need a statement outlining the planning situation, including available resources, area being considered, and outputs expected. A separate statement should be developed for each planning alternative anticipated in the planning activity. In the following example, the alternatives and the statements will be purposely less complete than they might be in a real planning situation. Nevertheless, these examples should indicate how the process might be used in land planning.

Our general statement might go like this: you are developing a multiple-use management program for an undeveloped roadless area. The area is several townships in size, with virtually no developed access. It is adjacent to an established wilderness area. Potential resources include timber, wildlife, water, range, and recreation. One management alternative emphasizes timber and wildlife, with the use of other resources as appropriate. A second management alternative emphasizes wildlife and recreation, with modest utilization of timber, and utilization of remaining resources as appropriate. The third management alternative considers wilderness the primary management objective.

Having outlined the general situation and three broad management alternatives, we can proceed to utilize PATTERN in our planning. Again, as in our example for purchasing a car, we must develop the relevance tree for ranking the importance of various components. Figure 5 depicts a relevance tree for our situation. Several variations on this basic relevance tree certainly could have been developed; however, we decided that we would discuss resource potential for the planning area, which includes the traditional values, and then the site factors and forces that change resource flows, depending upon how they are developed. We therefore must consider basic site factors, basic biological factors, and dynamic forces that affect the site and biological components.

Our relevance tree then can be converted from the form shown in figure 5 to a matrix as shown in figure 6. As can be seen in figure 6, the matrix considers only resource potential and site factors and forces. This matrix can be utilized for each of the planning alternatives outlined above, and provide input in balancing resource potential and resource demand. After all, this balancing is planning. We are trying to harmonize the utilization of the biological and physical potential of an area, as dictated by demand, in some form of management strategy. The document resulting from this balancing exercise, providing direction to the land manager, is the management plan.

Our example shows the relevance tree converted into a two-dimensional decision matrix (fig. 6). The horizontal axis represents forest resource potential. The vertical axis represents the various site factors. Again, as illustrated in our earlier example on car procurement, each cell in the matrix will eventually be assigned a relevance score or percentage by each participant. Each of these relevance scores indicates the participant's perception of the relative importance of the items of the matrix as they relate to each of the planning alternatives.

You may develop any number of relevance trees, depending upon the specific situation. A relevance tree is most effective when each item in the tree is mutually exclusive of the others. Extreme interdependence makes it difficult to make decisions and rank the individual items. All components of the tree should be defined so there is no question as to the intent or the meaning of the specific terms.

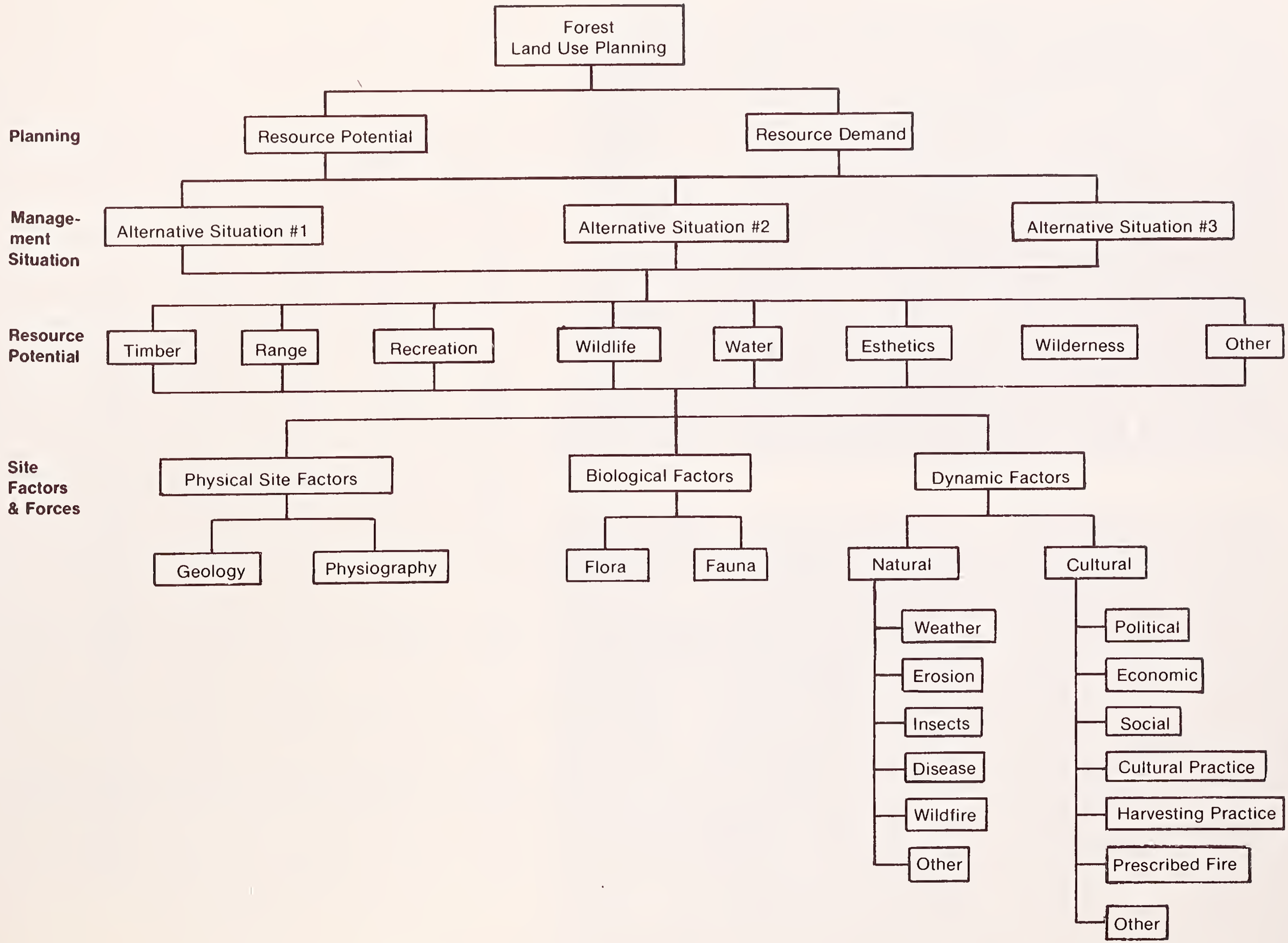

Figure 5.--General land use planning relevance tree.

Site factors and forces (summed vertically)	Forest Resource-Potential (summed laterally)								
	Timber	Range	Recreation	Wildlife	Water	Esthetics	Wilderness	Other (specify)	Total
Geology and physiography	+	+	+	+	+	+	+		= 100%
+									
Flora and fauna	+	+	+	+	+	+	+		= 100%
+									
Erosion	+	+	+	+	+	+	+		= 100%
+									
Insects and disease	+	+	+	+	+	+	+		= 100%
+									
Wildfire	+	+	+	+	+	+	+		= 100%
+									
Political and social forces	+	+	+	+	+	+	+		= 100%
+									
Economics	+	+	+	+	+	+	+		= 100%
+									
Management practices	+	+	+	+	+	+	+		= 100%
+									
Prescribed fire	+	+	+	+	+	+	+		= 100%
+									
Other (specify)	+	+	+	+	+	+	+		= 100%
Total = 100%									

Figure 6.--General relevance tree matrix with site factors and forces in first-order position.

AN OPERATIONAL EXAMPLE

Let us suppose you want to use this technique in your land management planning. It might be useful within the interdisciplinary team to develop individual and team values. The tool could also be used with special interest groups as an objective means for quantifying relative values.

Once the planning objectives are developed along with the situation description, the general procedures for PATTERN are outlined to the group. A very simple example of PATTERN might be presented to the group, perhaps similar to the car example. Work a sample exercise, allowing enough time to insure that everyone understands the process. This example can be used to show participants how relevance trees are developed and relevance values are determined. Before moving into a land management PATTERN exercise, answer all questions. Based on our own experience, this introductory exercise is well worth the time.

Upon completion of the sample exercise and question period, the real exercise can begin. All participants can be told something similar to the following:

> Review the situation statement and the planning alternatives. Remember, decisions are usually made using an array of inputs. The relevance tree may not be all inclusive. Inputs from several other individuals and sources and feedback may be desirable. However, your general responses are provided on the basis of the factors considered most important in the planning and management of the described alternative.

The participants can then be told:

> Indicate the relative weights (in percentage) of each of the components for the planning alternative described. Values you assign to the site factors and forces in the left-hand column should total 100 percent. (These values are called *first-level* relevance scores.) It is not necessary to have numbers in each cell; some cells may be left blank and will be treated as if zeros had been entered. If zeros are entered in the left-hand column, the appropriate row must also be left blank.

The second step requires each decisionmaker to:

> Evaluate the resource potentials that are outlined in the body of the relevance tree matrix. Then indicate the relative weights of each of these factors *within* the bounds of *each* of the site factors. All values you assign to items within each resource-potential site factor should total 100 percent. These are the *second-level* relevance scores.

Relevance Trees, General Concerns

Relevance values are sometimes in error. Sometimes values do not total 100 percent. When the row or column does not add up to 100 percent, a normalization procedure may be used. This procedure determines the relative weight of each cell in the row or column and then assigns a new value for each cell (keeping the same relative weight for each cell) so the total equals 100. For example: (0.25 + 0.15 + 0.20 + 0.20 + 0.10 + 0.20 = 1.10). Normalized to 1.00 or 100 precent the values would be (0.227 + 0.136 + 0.182 + 0.91 + 0.182 = 1.00).

Conversion of Raw Scores

Second-level values for a first-level category are multiplied by that first-level category score. This procedure adjusts all second-level scores throughout the relevance tree matrix so that they total 100 percent. Figure 7 shows a relevance tree matrix like figure 6 completed by a participant. First, the left-hand column (first-level relevance score) was filled into total 100 percent vertically. Secondly, the horizontal rows (second-level scores) were considered within the item in the left-hand column and were completed so each row totals 100 percent horizontally.

Combining Relevance Tree for Each Planning Alternative

For each planning alternative, an *average* relevance tree can be computed for all participants by desired groupings. The average relevance tree can be developed by averaging the *adjusted* second-level scores within each cell of the matrix. Each cell's adjusted total score for all participants is divided by the total number of respondents in the specified grouping. Figure 8 is an example of an average adjusted relevance score matrix representing 339 individuals combined

	Site factors and forces (summed vertically)	Forest Resource-Potential (summed laterally)								
		Timber	Range	Recreation	Wildlife	Water	Esthetics	Wilderness	Other (specify)	Total
10	Geology and physiography	10 +	5 +	10 +	5 +	20 +	35 +	15 +	0	= 100%
+ 15	Flora and fauna	40 +	30 +	10 +	10 +	5 +	5 +	0 +	0	= 100%
+ 10	Erosion	20 +	5 +	5 +	0 +	20 +	40 +	10 +	0	= 100%
+ 5	Insects and disease	40 +	20 +	20 +	10 +	0 +	10 +	0 +	0	= 100%
+ 10	Wildfire	20 +	10 +	10 +	15 +	20 +	20 +	5 +	0	= 100%
+ 10	Political and social forces	15 +	15 +	10 +	10 +	5 +	5 +	40 +	0	= 100%
+ 15	Economics	40 +	10 +	20 +	5 +	15 +	5 +	5 +	0	= 100%
+ 20	Management practices	30 +	10 +	10 +	15 +	15 +	20 +	0 +	0	= 100%
+ 5	Prescribed fire	20 +	10 +	10 +	25 +	25 +	5 +	5 +	0	= 100%
+ 0	Other (specify)	0 +	0 +	0 +	0 +	0 +	0 +	0 +	0	= 100%
Total = 100%										

Figure 7.--An example of an individual's completed relevance tree matrix.

	RESOURCE POTENTIAL								
Site F/F	Timber	Range	Recreation	Wildlife	Water	Esthetic	Wilderness	Other	Total
GEO/PHYS	0.0115	0.0090	0.0285	0.0112	0.0233	0.0274	0.0030	0.0009	0.1149
FLO/FAUN	.1040	.0138	.0338	.0263	.0194	.0317	.0029	.0006	.1425
EROSION	.0125	.0108	.0196	.0066	.0318	.0194	.0013	.0011	.1031
INS/DIS	.0124	.0038	.0101	.0067	.0045	.0134	.0009	.0004	.0521
WILDFIRE	.0152	.0082	.0201	.0136	.0210	.0267	.0017	.0009	.1154
POL/SOC	.0204	.0132	.0498	.0210	.0263	.0364	.0044	.0011	.1725
ECONOMIC	.0128	.0106	.0279	.0096	.0171	.0147	.0018	.0010	.0956
MGT PRAC	.0184	.0136	.0363	.0207	.0268	.0324	.0027	.0012	.1522
RX FIRE	.0066	.0058	.0069	.0096	.0077	.0098	.0008	.0003	.0470
OTHER	.0012	.0007	.0010	.0005	.0006	.0006	.0002	.0001	.0048
Total	.1249	.0680	.2418	.1257	.1785	.2124	.0198	.0078	1.0000

Figure 8.--Adjusted average relevance scores for a matrix involving 339 respondents.

Interpreting Summaries and Comparisons

Up to this point you have been exposed to the process of PATTERN, the relevance tree, the matrices, and the adjusted relevance score. How does the planner use it? What possibilities does it have in helping you to do your job? As mentioned previously, PATTERN does *not* make decisions. PATTERN provides an assembly of information that is additional input to the decision process, which eventually becomes the final plan. It helps quantify, in an objective manner, some of the values important to people.

By applying PATTERN to each planning situation and its alternatives, you may compare the various scores to see changes in importance of values and change in perceptions by the same group. This change of importance then can help you weigh factors that enter into your management alternatives or your selection of a final management strategy. You can tie public issues to the kind of information presented in the example shown in the previous few pages. This is only an example and the relevance tree must be tailored to your own specific situation. Nevertheless, the relevance tree used in our example might fit your planning situation.

Let us reexamine figure 8. Here is an example of adjusted relevance scores for a large data base for a relevance tree matrix similar to the one outlined in this paper. These are the raw values. The totals at the bottom show that recreation ranked first; esthetics ranked second; water, third. Timber and the other traditional commodities were ranked below these. Therefore, you could use these scores when comparing the alternatives as seen by the participants. The site factors and forces most important to the participants are reflected in the largest values in the right-hand column. This may or may not be important, depending upon the management action alternatives for the area. It may be important, however, in determining the kind of management action for the area and help the manager make a decision.

You can also consider the highest value of each cell within the matrix and see the major combined factors that made up the totals. Referring back to the car purchasing exercise may show how you might apply the combined factors of interest. Working with data as outlined in figure 8 is one approach. It is sometimes difficult to work the raw numbers. The four decimal places as in figure 8 do not necessarily indicate great precision. The importance is not the value itself, but the relative difference of the value compared to other values. We cannot really distinguish between the importance of a 0.0240 as compared to a 0.0268.

Sometimes it is helpful to categorize the data and stratify them in bigger components or "chunks." Some people have preferred quartile breakdowns. Data are stratified by ranges in which one-fourth of the data is in the upper set, one-fourth in the lower set, one-fourth in the upper middle and one-fourth in the lower middle. Figure 9 represents a quartile breakdown of data presented in figure 8. The bottom of the table indicates the ranges of the relevance scores for each quartile, for example the upper quartile ranges from 0.0204 through 0.0498. The sum of the individual relevance values within those upper quartile cells is equal to 57.65; this tells us that more than 57 percent of all the value ascribed to all the cells in that matrix falls into the upper quartile, so it is fairly important.

In this case the 4 and 3 indicate which quartile the cell belongs in. The quartile diagram represents values as stratified into larger groups. If you use a quartile diagram for each of the planning situations and alternatives, you may see a shift in the position of the upper-middle, lower-middle and lower items. This helps identify the shift of issue importance by planning situation. This procedure can be used for linking information with the issues identified by the publics.

In reviewing the quartile summary example, the 20 most important items (upper quartile) account for 57.65 percent

	SITE FACTORS AND FORCES							
Res Potn	Timber	Range	Recreation	Wildlife	Water	Esthetic	Wilderness	Other
GEO/PHYS	3	2	4	3	4	4	2	1
FLO/FAUN	3	3	4	4	3	4	2	1
EROSION	3	3	3	2	4	3	1	1
INS/DIS	3	2	2	2	2	3	1	1
WILDFIRE	3	2	4	3	4	4	2	1
POL/SOC	4	3	4	4	4	4	2	1
ECONOMIC	3	3	4	2	3	3	2	1
MGT PRAC	3	3	4	4	4	4	2	1
RX FIRE	2	2	2	2	2	2	1	1
OTHER	1	1	1	1	1	1	1	1

	QUARTILE:	UPPER	UPPER MIDDLE	LOWER MIDDLE	LOWER
		4	3	2	1
Sum of the percentages within each quartile		57.65	28.72	12.08	1.55
Range of percentages within each quartile		0.0498-0.0204	0.0196-0.0106	0.0101-0.0017	0.0013-0.0001

Figure 9.--Average relevance tree quartile summary and statistics, 339 respondents.

of the total adjusted values. The upper and upper-middle quartiles combined account for 86.37 percent of the total (fig. 9). Resource Potential Factors, Recreation, Esthetics, and Water provide the greatest share of the upper quartile values. In terms of Site Factors and Forces, however, Political and Social Forces and Management Practices appear to be the leaders. Individual factors, Political and Social Forces, Management Practices, Flora and Fauna, and Wildfire ranked 1 through 4, respectively, for this example.

The top five combined factors (fig. 8) account for 18.87 percent of the total relevance tree. This means 6 percent of the cells are accounting for about 20 percent of the importance. The items scoring in the top five in descending order are:

1. Political and Social Forces/Recreation
2. Political and Social Forces/Esthetics
3. Management Practices/Recreation
4. Flora and Fauna/Recreation
5. Management Practices/Esthetics.

The quartile summary for this situation shows a clustering of upper quartile values. The upper quartile accounted for over 50 percent of the total tree.

Critical Decisions

Our use of PATTERN has illustrated the respondents' opinions of important considerations for one planning alternative. Agreement and disagreement can be identified among, between, and within various respondent stratifications. These relevance tree data provide the interacting priorities for the management alternatives presented. In our example, 25 percent of the adjusted relevance scores accounted for approximately 50 percent of the entire relevance tree value. Pooling data for all respondents tends to to mask the diversity found on a stratified basis. The smoothing further tends to hide internal differences.

Data generated by this technique can tell managers and planners how others view alternatives. These kinds of data can also help indicate important constraints in various situations. Through a more complete understanding and a more objective evaluation of important factors, planners and managers can better evaluate activities as well as better understand the public perceptions.

The relevance trees, quartile diagrams, and other types of data stratification depict the respondents' concepts of the various relationships of pertinent factors. As indicated by Shafer and others (1974), this type of analysis can also be helpful in developing decision games for evaluating the consequences of various alternatives. Furthermore, results can be used for determining changes in attitude in the future.

The technique used, PATTERN, appears to be useful for developing individual management plans. The process provides an objective procedure to assess, order, and eventually integrate multiple factors in a two-dimensional matrix. Planning teams can use such a procedure to quantitatively assess their posture or the position of various publics on various planning issues for which relevance trees can be constructed. Individuals outside of planning might also be included in the process, especially in situations of great diversity of opinion. The process allows developing an objective analysis of some subjective information. PATTERN is another tool to assist in the task of planning.

PUBLICATIONS CITED

Barney, Richard J.
1976. Land use planning--fire management relationships and needs in the U.S. Forest Service. Ph.D. diss. Mich. State Univ., East Lansing. 244 p.

Bright, James R.
1974. A brief introduction to technology forecasting--concepts and exercises. 248 p. Permaquid Press, Austin, Tex.

Esch, Maurice E.
1969. Relevance tree methodology. 17 p. Military and Space Dep., Honeywell, Inc., Arlington, Va.

Gordon, Theodore J., and M. J. Roffensperger.
1973. The relevance tree method for planning basic research. *In* A guide to practical technical forecasting. p.126-146. Prentice-Hall, Inc., Englewood Cliffs, N.J.

Jantsch, Erich.
1968. Integrating forecasting and planning through a function-oriented approach. *In* Technical forecasting for industry and government. p. 426-448. Prentice-Hall, Inc., Englewood Cliffs, N.J.

Martino, Joseph P.
1972. Technological forecasting for decisionmaking. 750 p. Elsevier Publ. Co., Inc., New York.

Shafer, Elwood L. Jr., George Moeller, Douglas A. Morrison, and others. 1974. Recreation, resources, and right decisions. USDA For. Serv. Res. Pap. NE-293, 16 p. Northeast. For. Esp. Stn., Broomall, Pa.

SUGGESTED READINGS

Bright, James R.
1974. A brief introduction to technology forecasting--concepts and exercises. 248 p. Permaquid Press, Austin, Tex.

Martino, Joseph P.
1972. Technological forecasting for decisionmaking. 750 p. Elsevier Publ. Co., Inc., New York.

Prentice-Hall, Inc.
1973. A guide to practical technological forecasting. 651 p. Englewood Cliffs, N.J.

Shafer, Elwood L., Jr., George Moeller, Douglas A. Morrison, and others. 1974. Recreation, resources, and right decisions. USDA For. Serv. Res. Pap. NE-293, 16 p. Northeast. For. Exp. Stn., Broomall, Pa.

The Intermountain Station, headquartered in Ogden, Utah, is one of eight regional experiment stations charged with providing scientific knowledge to help resource managers meet human needs and protect forest and range ecosystems.

The Intermountain Station includes the States of Montana, Idaho, Utah, Nevada, and western Wyoming. About 273 million acres, or 85 percent, of the land area in the Station territory are classified as forest and rangeland. These lands include grasslands, deserts, shrublands, alpine areas, and well-stocked forests. They supply fiber for forest industries; minerals for energy and industrial development; and water for domestic and industrial consumption. They also provide recreation opportunities for millions of visitors each year.

Field programs and research work units of the Station are maintained in:

Boise, Idaho

Bozeman, Montana (in cooperation with Montana State University)

Logan, Utah (in cooperation with Utah State University)

Missoula, Montana (in cooperation with the University of Montana)

Moscow, Idaho (in cooperation with the University of Idaho)

Provo, Utah (in cooperation with Brigham Young University)

Reno, Nevada (in cooperation with the University of Nevada)

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